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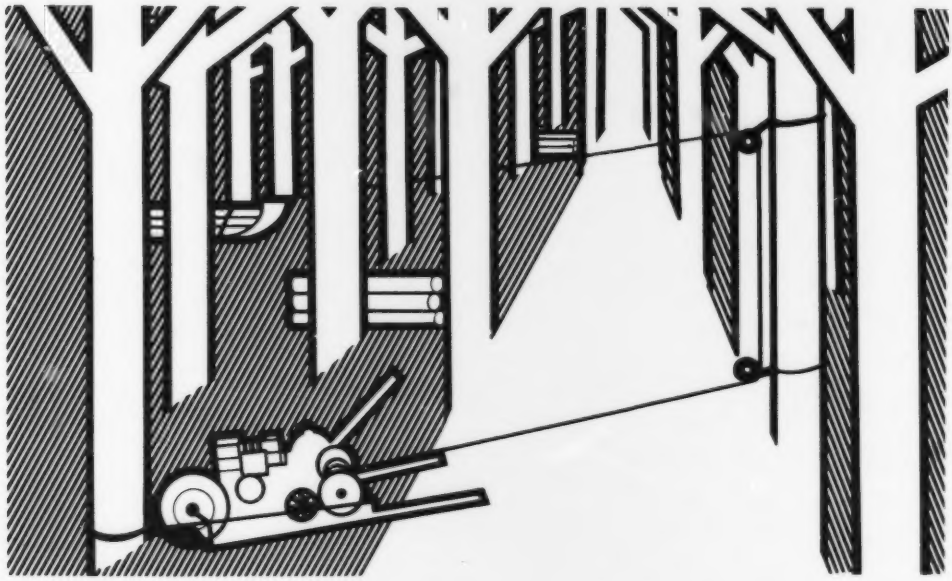
Forestry Notes

APPROPRIATE TECHNOLOGY FUELWOOD HARVESTING



A Joint Publication with
FOREST EXTENSION SERVICE
DEPARTMENT OF NATURAL RESOURCES
PROVINCE OF NEW BRUNSWICK

ACKNOWLEDGEMENTS

The authors would like to thank the following people for their assistance in developing the equipment and operating techniques.

Lucie Brunelle, Forest Extension Service, Province of New Brunswick, for original artwork.

Steven Castor, student, Department of Agricultural Engineering, for design and fabrication of the skidding sled.

Paul Francoeur, student, School of Forest Resources, who worked as cutter, choker setter and winch operator, for development of winching techniques and for data analysis.

Charles Gadzik, Consulting Forester, Rangeley, Maine, for development of shortwood cutting and handling techniques.

Raphael E. L. Ole Meilude, Forestry Department, University of Dar Es Salaam, Morogoro, Tanzania, for his help in the design and operating techniques of the sulky.

Henrik Portin, Forestry Officer, Vasa, Finland, for assistance in work studies and development of operating techniques.

Professor Norman Smith, Chairman, Department of Agricultural Engineering, University of Maine at Orono, for the design of the "Yankee Yarder".

Technician staff and students of the Department of Agricultural Engineering, for fabrication of equipment and technical drawings.

Marvin W. Blumenstock, Extension Forester, Cooperative Extension Service, University of Maine at Orono, and Joakim Hermelin, Director Forest Extension Service, Province of New Brunswick, for encouragement.

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Published and distributed in furtherance of Acts of Congress of May 8 and June 30, 1914, by the Cooperative Extension Service, Austin E. Bennett, Acting Director—the University of Maine at Orono and the United States Department of Agriculture cooperating.

APPROPRIATE TECHNOLOGY FUELWOOD HARVESTING

by

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Appropriate Technology Fuelwood Harvesting

Following the 1973 Arab oil embargo and its accompanying price increases and threats of shortages, wood again became an important home-heating fuel. Access to a chain saw and pickup truck offered homeowners a chance to become energy independent, and to save money. Woodcutting also increased family togetherness, and a pile of split, drying wood provided a new sense of security in days of increasing prices and diminishing supplies.

Woodburning also offered an opportunity to improve the forest by providing a market for a large surplus of low grade material - weeds - which needed to be removed to improve quality growth. But a few years of cutting quickly exhausted the roadside wood which was accessible to weekend woodcutters. Without machinery to get back into the woods, the woodcutter was at a severe disadvantage, and unless the forester could find a way to increase wood accessibility, forest improvement would amount to little more than roadside beautification.

The School of Forest Resources and Agricultural Engineering Department, University of Maine at Orono, have jointly developed some low cost, simple, appropriate technology wood harvesting systems. To keep capital costs down, the techniques are labor intensive, using simple tools and manual methods, old and new, for maximizing human productivity.

Manual wood handling requires cutting trees into sections which can be easily moved by one person, yet efficiency demands that the number of pieces be minimized. Thus, a shortwood cutting and bunching system, similar to those used in Scandinavia for thinning operations, has been developed. For low-cost transport of shortwood, two energy-efficient systems have been devised:

1) A 3 hp, high-lead cable system capable of extracting wood for distances up to 300 feet.

2) A sulky, pulled by hand, animal or garden tractor, capable of extracting wood over distances of 400-600 feet.

These systems may be used in combination with snowmobiles, 4-wheel drive vehicles and other transport equipment, depending upon terrain and weather conditions.

Planning the operation

With heavy dependence upon manual labor and low horsepower machines, working smarter, not harder, is a necessity. The most important part of the operation is planning.

The basic problem in harvesting wood without the use of logging machinery is to get the transport vehicle as close to the wood as possible, without getting stuck or damaging the equipment. On firm, dry soils and gently sloping terrain, roads passable by a pickup truck can be constructed by cutting stumps flush to the ground and filling depressions with short pieces of wood or slash. Whenever possible, existing woods roads and trails should be utilized. After establishing the limits of safe truck access, logging system planning begins.

The first stage in transport is falling the tree. A skilled cutter can fall trees toward the road, reducing the transport distance, but inexperienced workers should fall trees to their natural lay, being careful not to damage the residual trees.

After falling the tree and bucking it into lengths which he can handle - 8-12 feet being practical for small trees - the cutter piles the pieces for subsequent transport. Each pile should be large enough for a full load for the transport vehicle, and it should be oriented so as to make the transport phase as easy as possible. One person can cut and pile 2-4 cords of wood per 8 hour day, depending upon skill and tree size. Productivity is greater as

tree size increases, but handling becomes more difficult.

For initial transport, either cable or sulky may be used, depending on ground conditions. The cable system is most efficient for distances up to 150-200 feet and is adaptable to any terrain. Two people can move 8-10 cords of bunched shortwood in an 8 hour day using this method.

If ground conditions are good, the sulky is good for moving wood over distances of 300-400 feet. One person can haul 200-300 pounds of wood per trip. A more rugged model, pulled by two people or a garden tractor, can handle 500 pounds or more over longer distances, and two people can transport about 3 cords per day.

A combination of the two systems might be used, with cable for extracting wood to a trail and the sulky for transport to the truck road, as shown below.

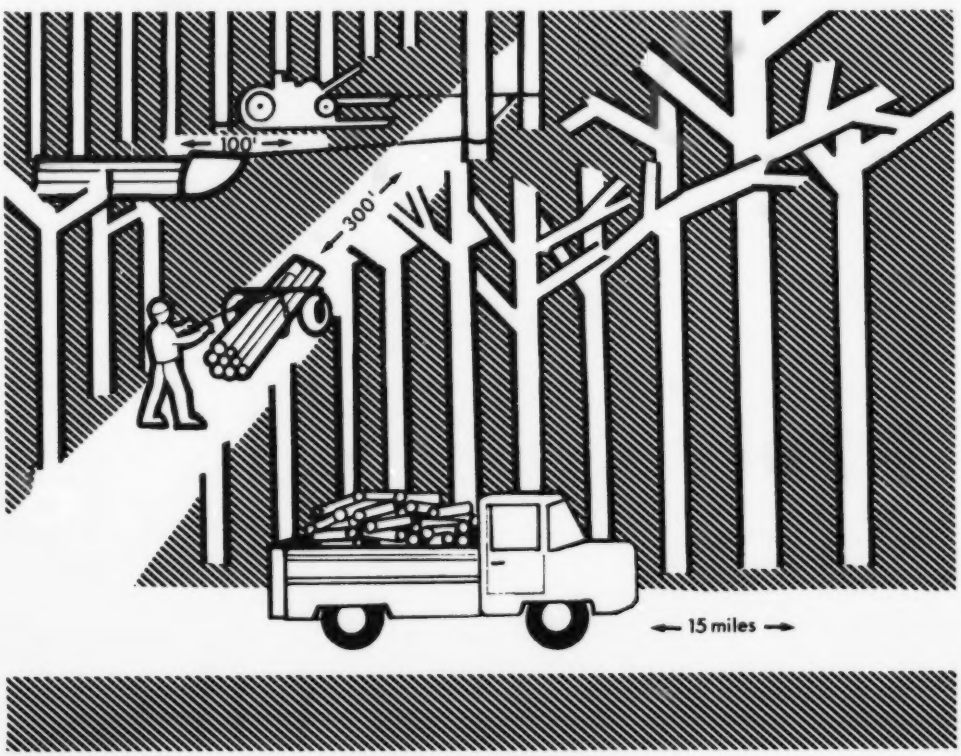


Fig. 1. An appropriate technology wood harvest system.

Cutting

The top cut of the notch (Fig 2) is made first to establish the direction of fall. When the bottom cut is made, the chip will fall out as soon as the cut is completed, reducing the chance of cutting away the holding wood. Note that the cutter carries his tools with him on a belt. The pulp hook (right hip) is used to turn logs and as a level to wedge trees, and the logger's tape is used to measure logs. On the left hip are lifting tongs, in a holster, for lifting and dragging logs. The pants have sewn-in safety pads to provide protection from chainsaw cuts.

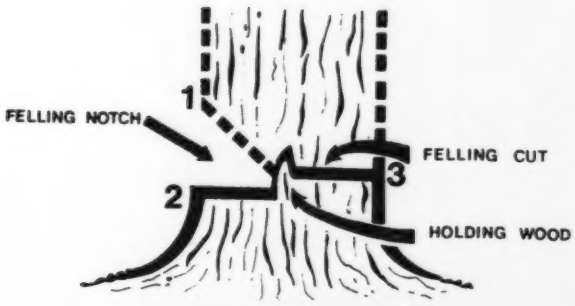


Fig. 2. Felling the tree.

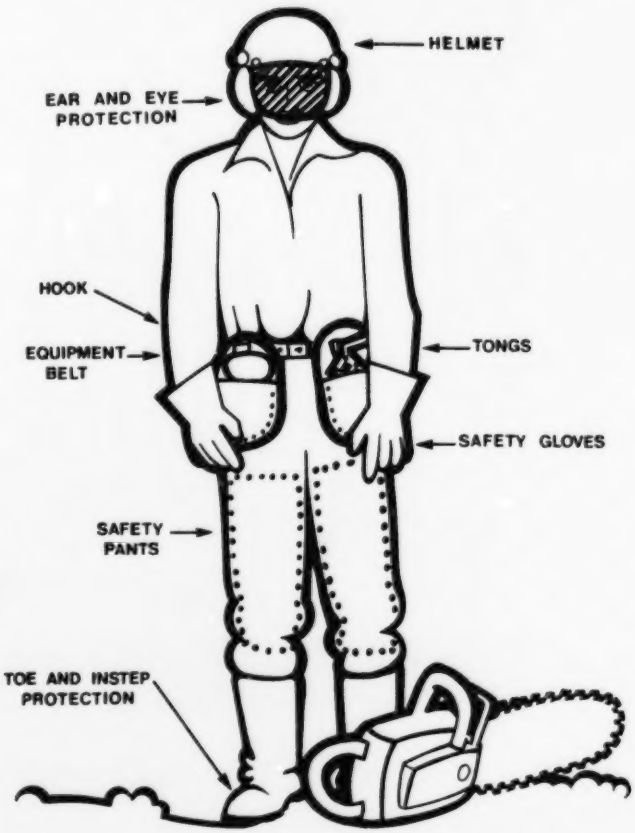


Figure 3. Limbing is made easier by felling over a "bench". This elevates the stem off the ground, making work easier and reducing the chance of hitting stones and soil with the bar tip.

Figure 4. With the logger's tape hooked to the butt of the tree, bucking cuts can be measured and marked while limbing. Bolt lengths should be a multiple of the stove length, but short enough for manual handling. With butts up to 6" diameter, 12 foot lengths can be handled easily. If diameters exceed 8", 8 foot lengths are maximum, and shorter pieces may occasionally be necessary.

Figure 5 illustrates the bucking cut. If two trees are felled side by side, limbing, measuring and bucking are speeded up. The cutter can limb and buck from stump to top on the first tree and work back to the stump on the second.

When bucking is completed, individual bolts can be dragged into bunches (piles) using Scandinavian lifting tongs (Fig. 6). Use the heaviest bolt as the basis for a bunch and drag the smaller pieces to it. Do not drag heavy pieces unless absolutely necessary. Bunches should be elevated above the ground, with front ends even, for easier choking with cable or chain.

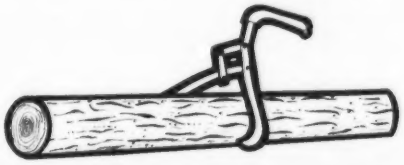


Fig. 6. Piling with Scandinavian lifting tongs.

Transportation

With labor intensive methods, the first stage of transportation is performed by the cutter. The trees are cut into bolts and piled in bunches which are pulled from the woods by cable or sulky. Figure 7 shows bunches of shortwood piled for cable skidding. Note that the bunches are piled in narrow corridors, ends oriented toward the road. The large amount of slash would make sulky transport very difficult; to use a sulky, the cutter would have to keep slash out of the corridor.

The "yankee yarder" is a portable winch powered by a 3 hp gasoline engine which can be moved like a wheelbarrow. Figure 8 shows the winch set up in a trail for a 4-wheel drive vehicle. Stumps were cut low and slash used to fill depressions. Wood is winched to and piled at the trailside where it can either be cut up and loaded or loaded long length and cut up after hauling.

The "yarder" requires a winch operator plus a choker setter to hook and unhook the load. By redesigning the winch to use a centrifugal clutch instead of a belt clutch, and with a rope control to the winch engine throttle, one person operation would be possible.

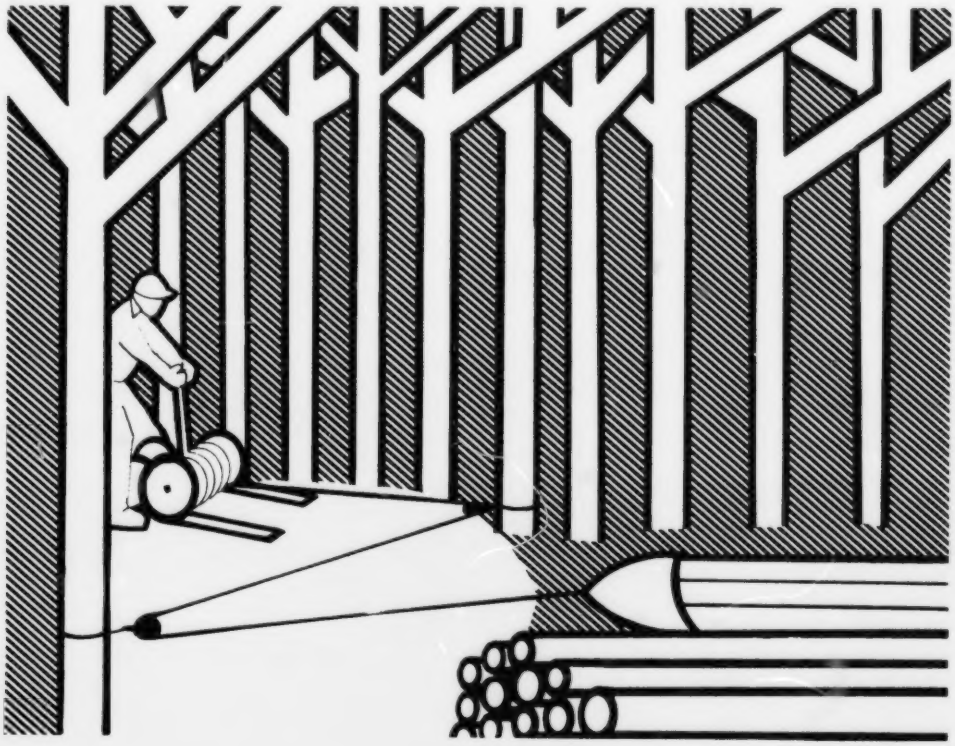


Figure 9 depicts the rigging of the yarder. One end of the winch is secured to a tree behind the operator, and the winch cable runs through an anchor block at the base of a tree on the opposite side of the trail. The winch is aligned between the tree and the anchor block and remains in that location until all wood within reach - an area of about one acre - is winched. From the anchor block, the cable runs to a high lead block (lower left) and then to the wood to be moved. Wood from the right side of the road can be winched from this high-lead block setting. To winch wood on the other side of the road, the block is relocated to a corner tree on the right side of the road.

The high lead block should be hung as high as possible, for the higher the lead, the lower the dragging resistance, an important factor when using low-powered machinery. A short ladder is helpful for hanging the block and can also be used as a ramp for winching wood onto piles at the trailside.

The bunches of wood are choked with the winch cable and a sled is shoved under the front end of the pile to facilitate skidding. The illustration shows a fiberglass sled from Finland, but home-made sleds and hoods from junked cars are equally suitable.

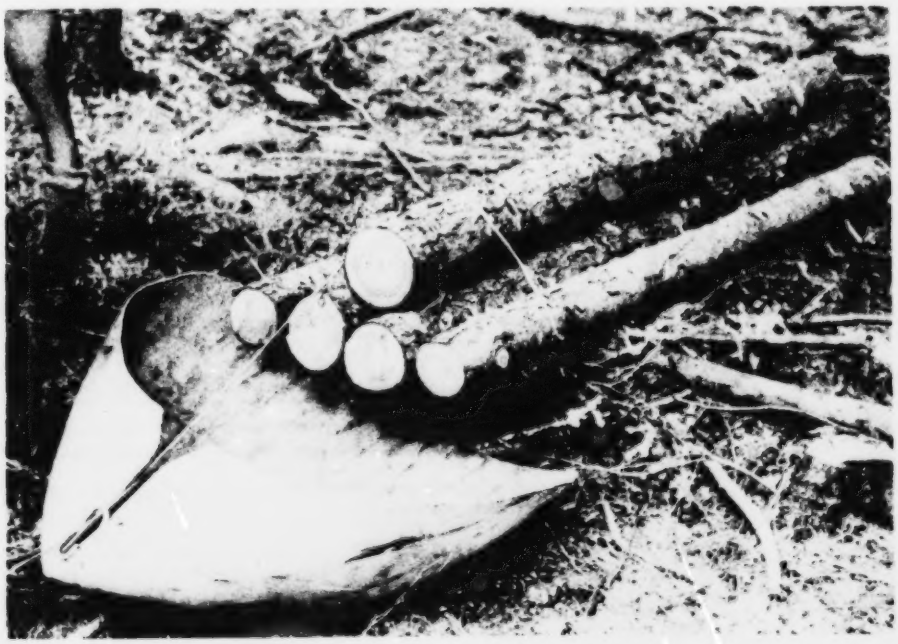
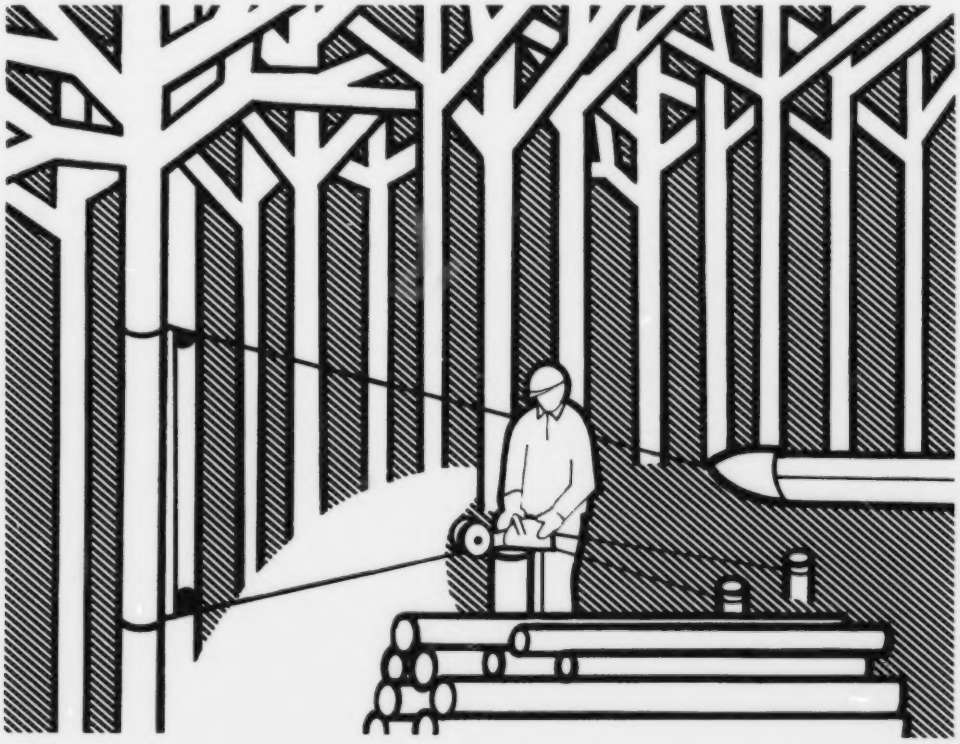


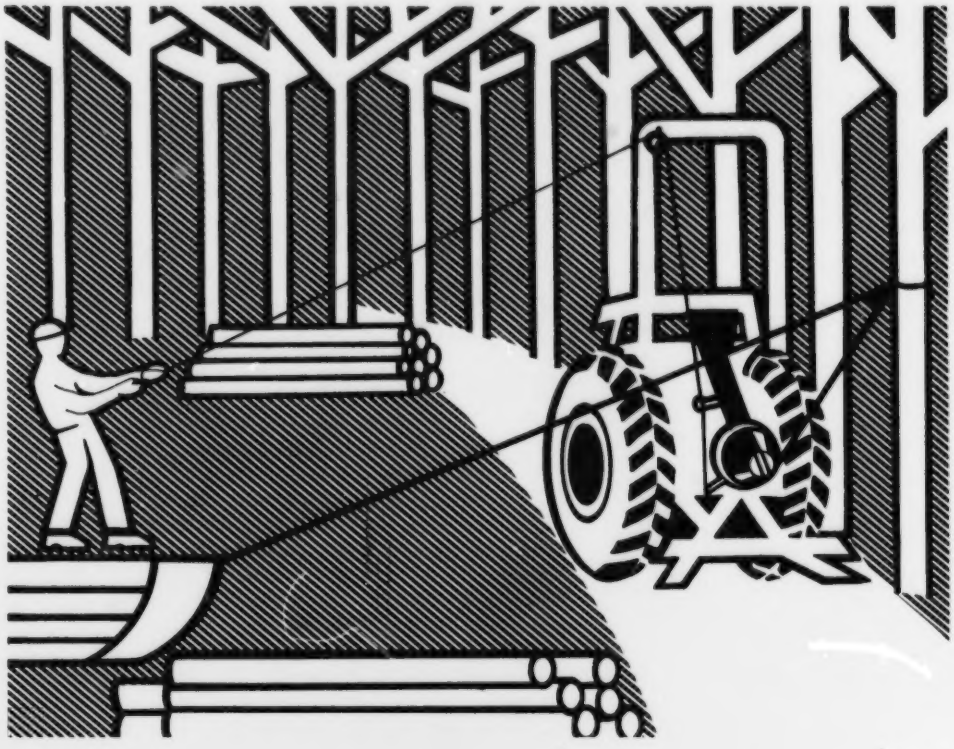
Figure 10. The sled enables heavy loads of wood to be winched through slash and over obstacles with low power without hanging up on stumps and in slash.

Chainsaw-powered winches are commercially available and are set up in the same manner as the portable winch. Figure 11 shows the winch operator using a high tree stump as a base for his winch, eliminating the need to bend or kneel when working.



For woodcutters who have access to a farm tractor, the same cable techniques can be used with a 3-point hitch winch as shown in Fig. 12. In this operation, the tractor is used as a portable winch platform. A nylon line extending from the tractor roll bar permits the operator to control the winch up to 90 feet from the tractor. If the tractor was also used to skid, the operator could winch the load to the self releasing snatch block. When the load hits the block, it is released and winched up to the rear of the tractor for skidding.

Fig. 12. Farm tractor and winch used for fuelwood harvesting.

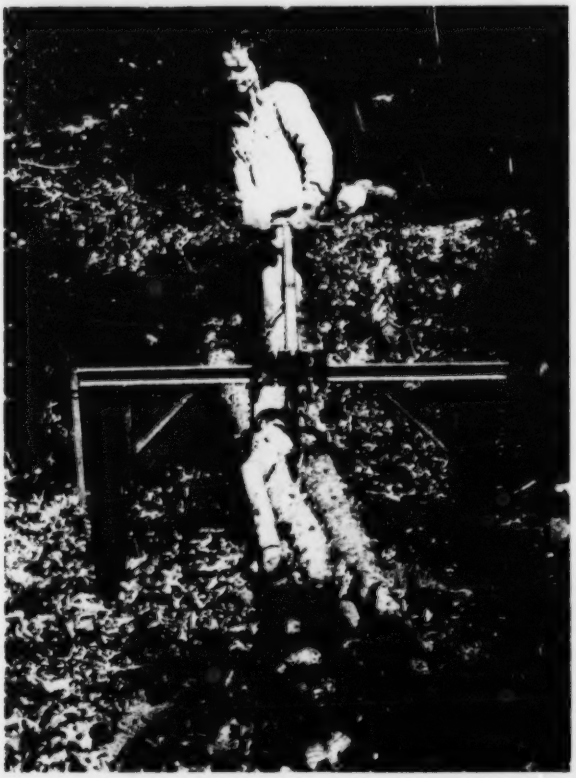


When ground conditions are favorable, the wheeled sulky (Fig. 13) can be used to transport small bunches of shortwood to the loading point. Wood should be choked at its center of gravity and lifted completely free of the ground for easiest movement; if it is hooked at one end and dragged, the work effort is greatly increased and productivity declines.

Wood is loaded in the sulky by tipping the handle up and positioning the chain notches over the center of the load. The choker chain is then hooked in a notch, and when the handle is pulled down, the load is lifted.

Fig. 13. Two-wheeled sulky with load of logs.

Figure 14. The sulky works best on good trails such as this old skid road. In this operation, 8 foot hardwood was dragged to the trail-side with tongs, then hauled several hundred feet to the truck with the sulky. A teen-ager weighing 110 pounds could easily handle 200 pound loads.



Conclusion

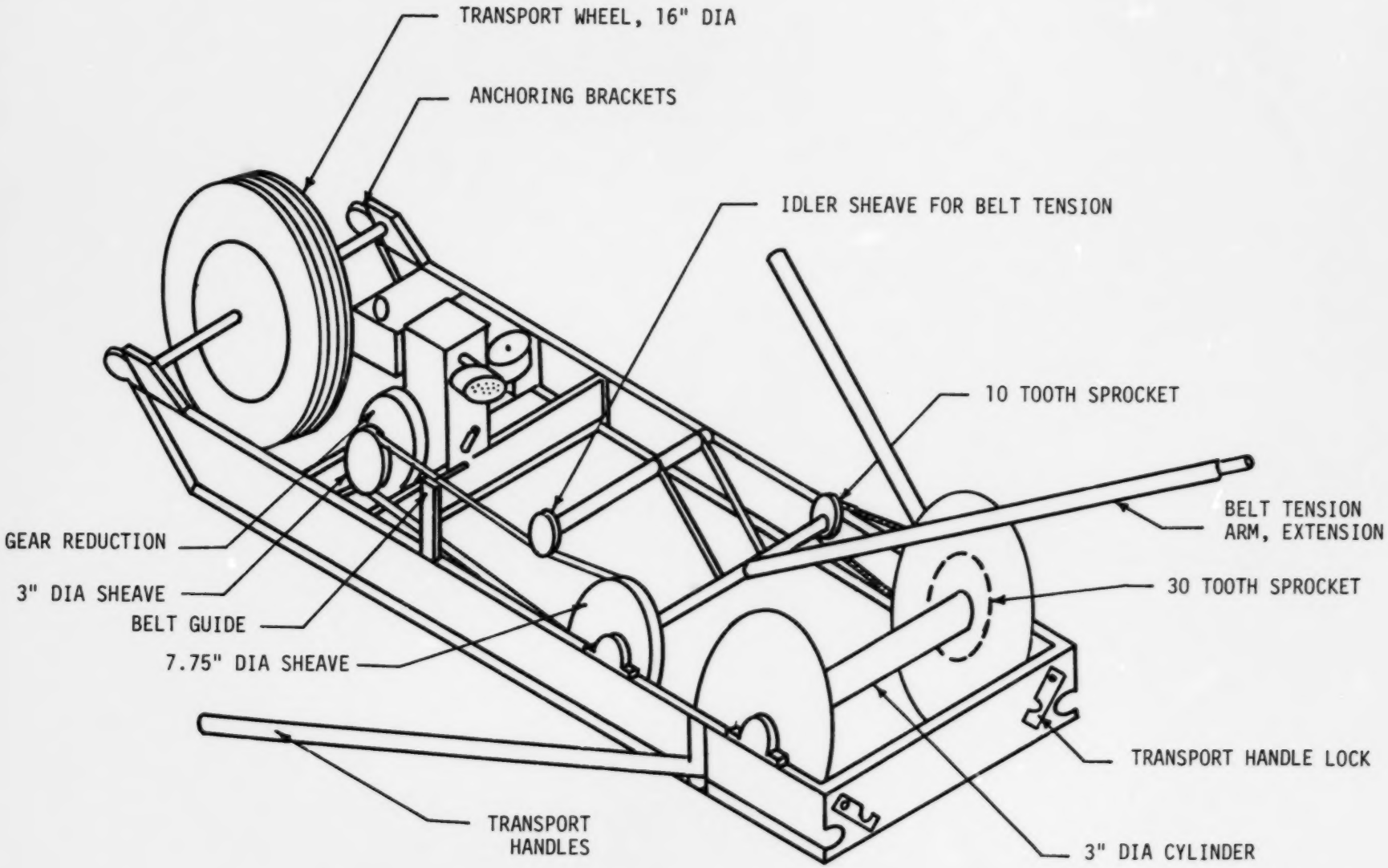
These are but a few simple approaches to the harvesting of fuelwood. Other inexpensive methods can be easily devised for snowmobiles, garden tractors and home-made machines. The chief ingredient is ingenuity.

Drawings of the "Yankee Yarder", the sulky and a sled are contained in the appendix, but potential builders of such equipment should use these as guides, not final plans. A number of improvements are already being made in these machines.

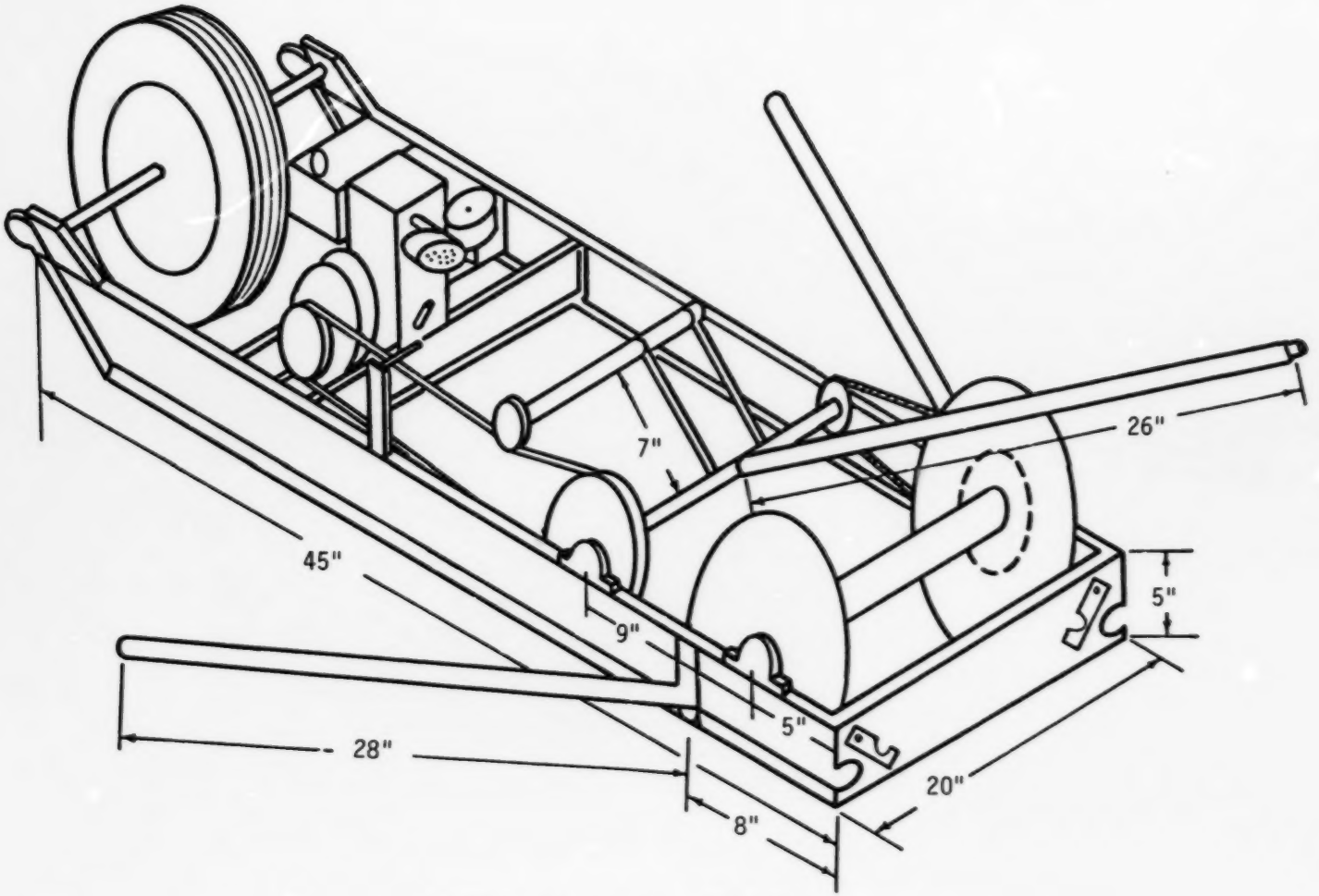
1) The clutch system on the winch is being redesigned for a centrifugal clutch and remote throttle control for one-man operation.
2) The sulky was redesigned for "mag" bicycle wheels with solid tires (pneumatic tires are prone to punctures) and a telescoping tongue to permit handling longer lengths.

The authors would be interested in any comments, suggestions and new ideas to pass along to other weekend warriors.

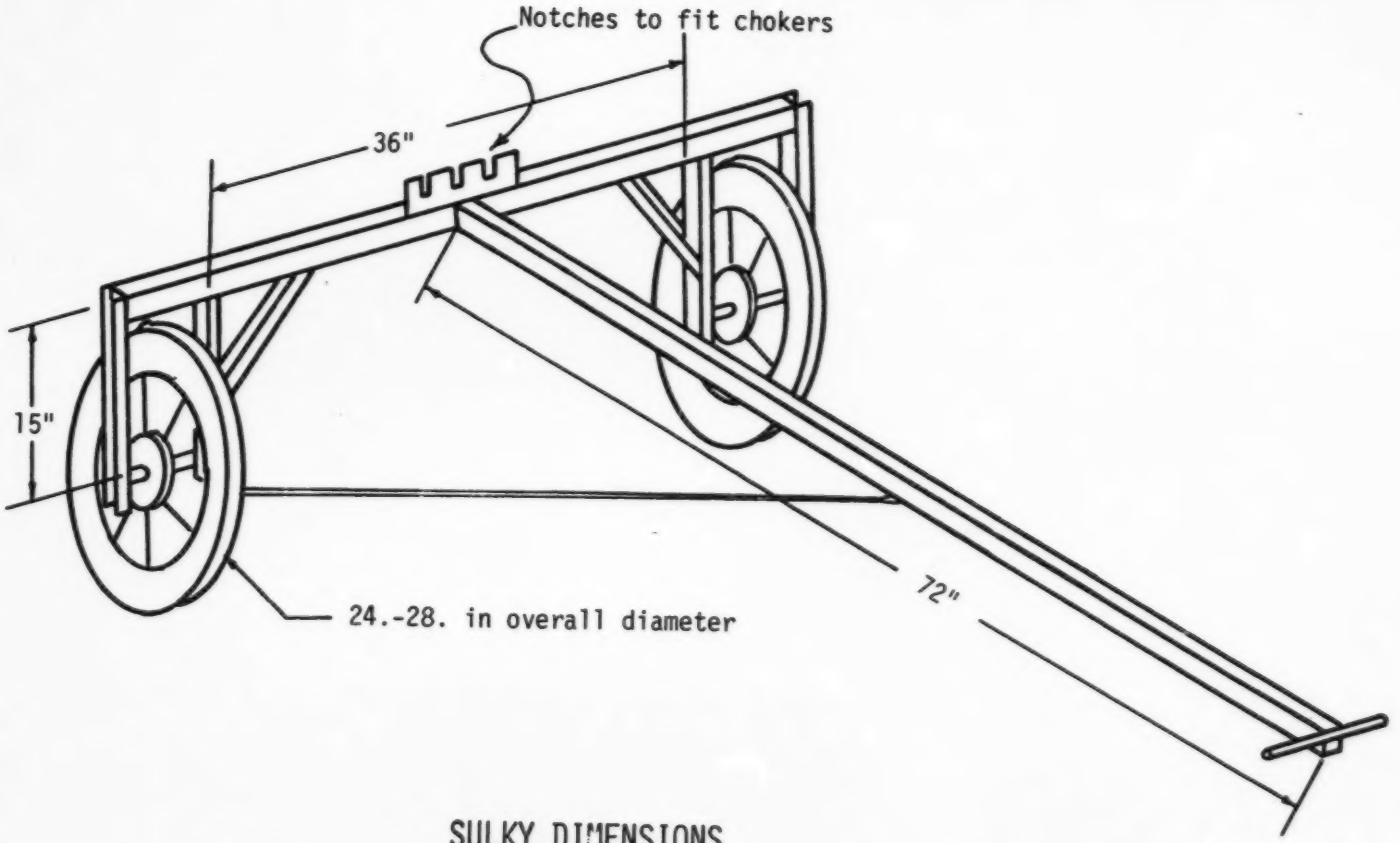
APPENDIX



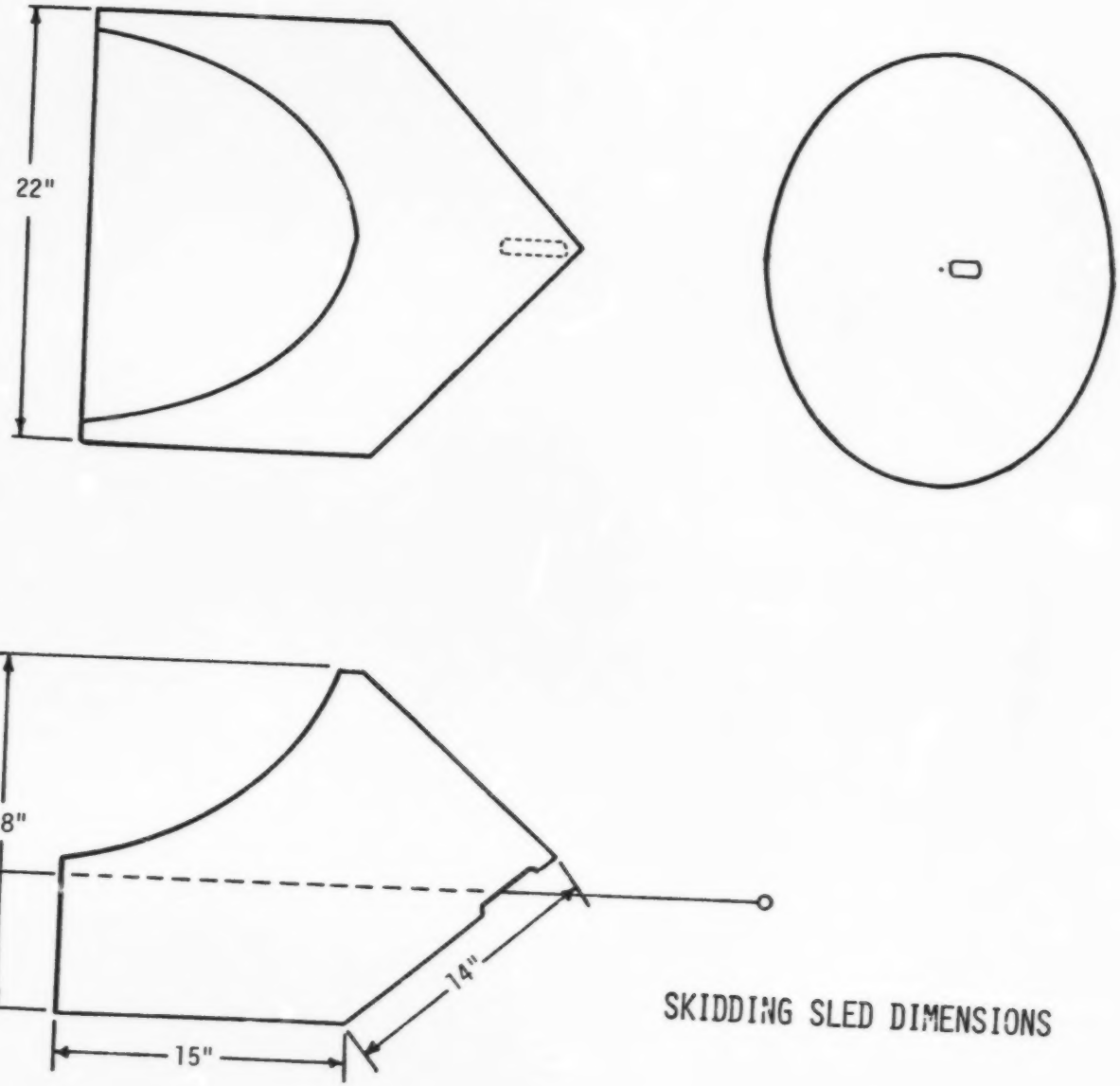
YANKEE YARDER DIAGRAM



YANKEE YARDER DIMENSIONS



SULKY DIMENSIONS



SKIDDING SLED DIMENSIONS

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